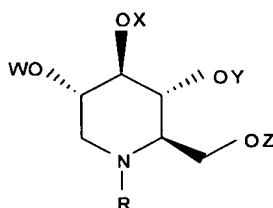


**What Is Claimed Is:**

1. A method for treating a hepatitis virus infection in a mammal, comprising administering to said mammal an anti-hepatitis virus effective amount of at least one *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound of Formula I or a pharmaceutically acceptable salt thereof:



(I)

wherein R is selected from the group consisting of straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, branched chain alkyl having a chain length of C<sub>3</sub> to C<sub>20</sub> in the main chain, alkoxyalkyl, arylalkyl, and cycloalkylalkyl, and

wherein W, X, Y and Z are each independently selected from the group consisting of hydrogen, alkanoyl, aroyl, and trifluoroalkanoyl.

2. The method of claim 1, wherein R is straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each hydrogen.

3. The method of claim 2, wherein R is nonyl.

4. The method of claim 1, wherein R is straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each alkanoyl.

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5. The method of claim 4, wherein R is nonyl.

6. The method of claim 5, wherein said alkanoyl is butanoyl.

7. The method of claim 1, wherein said *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound is selected from the group consisting of:

*N*-(n-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(n-octyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(n-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(n-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(n-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(n-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(n-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(n-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(n-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(n-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(n-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(n-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(n-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates

*N*-(n-octyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;

*N*-(n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;

*N*-(n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;

*N*-(n-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;

*N*-(n-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;

*N*-(n-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;

*N*-(n-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;

*N*-(n-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;



*N*-(n-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;



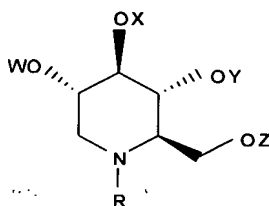
55            *N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
60            *N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
65            *N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
70            *N*-(3-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(9-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(7-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(3-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
              *N*-(3-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol; and  
75            *N*-(7,10,13-trioxa-n-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol.

8. The method of claim 1, wherein said pharmaceutically acceptable salt is selected from the group consisting of acetate, adipate, alginate, citrate, aspartate, benzoate, benzenesulfonate, bisulfate, butyrate, camphorate, camphorsulfonate, digluconate, cyclopentanepropionate, dodecylsulfate, ethanesulfonate, glucoheptanoate, 5 glycerophosphate, hemisulfate, heptanoate, hexanoate, fumarate, hydrochloride, hydrobromide, hydroiodide, 2-hydroxy-ethanesulfonate, lactate, maleate, methanesulfonate, nicotinate, 2-naphthalenesulfonate, oxalate, palmoate, pectinate,



persulfate, 3-phenylpropionate, picrate, pivalate, propionate, succinate, tartrate, thiocyanate, tosylate, mesylate, and undecanoate.

9. A method for treating a hepatitis virus infection in a mammal, comprising administering to said mammal an antiviral composition comprising an antiviral effective amount of at least one *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound of Formula I or a pharmaceutically acceptable salt thereof:



( I )

wherein R is selected from the group consisting of straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, branched chain alkyl having a chain length of C<sub>3</sub> to C<sub>20</sub> in the main chain, alkoxyalkyl, arylalkyl, and cycloalkylalkyl, and

wherein W, X, Y and Z are each independently selected from the group consisting of hydrogen, alkanoyl, aroyl, and trifluoroalkanoyl.

10. The method of claim 9, wherein R is straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each hydrogen.

11. The method of claim 10, wherein R is nonyl.

12. The method of claim 9, wherein R is straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each alkanoyl.



13. The method of claim 12, wherein R is nonyl.

14. The method of claim 13, wherein said alkanoyl is butanoyl.

15. The method of claim 9, wherein said *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound is selected from the group consisting of:

*N*-(n-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(n-octyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(n-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(n-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(n-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(n-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(n-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(n-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(n-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(n-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(n-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(n-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(n-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate

*N*-(n-octyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;

*N*-(n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;

*N*-(n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;

*N*-(n-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;

*N*-(n-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;

*N*-(n-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;

*N*-(n-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;

*N*-(n-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;



*N*-(*n*-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(*n*-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(*n*-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(*n*-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(*n*-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;



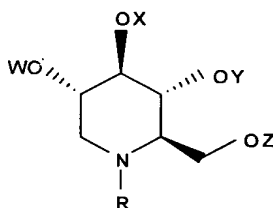
55 *N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
60 *N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
65 *N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
70 *N*-(3-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(9-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
*N*-(3-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol; and  
75 *N*-(7,10,13-trioxa-n-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol.

16. The method of claim 9, wherein said pharmaceutically acceptable salt is selected from the group consisting of acetate, adipate, alginate, citrate, aspartate, benzoate, benzenesulfonate, bisulfate, butyrate, camphorate, camphorsulfonate, digluconate, cyclopentanepropionate, dodecylsulfate, ethanesulfonate, glucoheptanoate, 5 glycerophosphate, hemisulfate, heptanoate, hexanoate, fumarate, hydrochloride, hydrobromide, hydroiodide, 2-hydroxy-ethanesulfonate, lactate, maleate, methanesulfonate, nicotinate, 2-naphthalenesulfonate, oxalate, palmoate, pectinate,



persulfate, 3-phenylpropionate, picrate, pivalate, propionate, succinate, tartrate, thiocyanate, tosylate, mesylate, and undecanoate.

17. A method for treating a hepatitis virus infection in a mammal, comprising administering to said mammal an antiviral composition consisting essentially of an antiviral effective amount of at least one *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound of Formula I or a pharmaceutically acceptable salt thereof:



( I )

wherein R is selected from the group consisting of straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, branched chain alkyl having a chain length of C<sub>3</sub> to C<sub>20</sub> in the main chain, alkoxyalkyl, arylalkyl, and cycloalkylalkyl, and

wherein W, X, Y and Z are each independently selected from the group consisting of hydrogen, alkanoyl, aroyl, and trifluoroalkanoyl.

18. The method of claim 17, wherein R is straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each hydrogen.

19. The method of claim 18, wherein R is nonyl.

20. The method of claim 17, wherein R is straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each alkanoyl.



21. The method of claim 20, wherein R is nonyl.

22. The method of claim 21, wherein said alkanoyl is butanoyl.

23. The method of claim 17, wherein said *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound is selected from the group consisting of:

*N*-(n-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-octyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate  
*N*-(n-octyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;



*N*-(n-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;



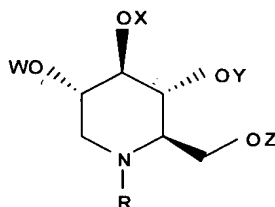
55 *N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
60 *N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
65 *N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
70 *N*-(3-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(9-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
*N*-(3-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol; and  
75 *N*-(7,10,13-trioxa-n-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol.

24. The method of claim 17, wherein said pharmaceutically acceptable salt is selected from the group consisting of acetate, adipate, alginate, citrate, aspartate, benzoate, benzenesulfonate, bisulfate, butyrate, camphorate, camphorsulfonate, digluconate, cyclopentanepropionate, dodecylsulfate, ethanesulfonate, glucoheptanoate, 5 glycerophosphate, hemisulfate, heptanoate, hexanoate, fumarate, hydrochloride, hydrobromide, hydroiodide, 2-hydroxy-ethanesulfonate, lactate, maleate, methanesulfonate, nicotinate, 2-naphthalenesulfonate, oxalate, palmoate, pectinate,



persulfate, 3-phenylpropionate, picrate, pivalate, propionate, succinate, tartrate, thiocyanate, tosylate, mesylate, and undecanoate.

25. A method for treating a hepatitis virus infection in a mammal, consisting essentially of administering to said mammal an antiviral effective amount of at least one *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound of Formula I or a pharmaceutically acceptable salt thereof: ✓



(I)

wherein R is selected from the group consisting of straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, branched chain alkyl having a chain length of C<sub>3</sub> to C<sub>20</sub> in the main chain, alkoxyalkyl, arylalkyl, and cycloalkylalkyl, and

wherein W, X, Y and Z are each independently selected from the group consisting of hydrogen, alkanoyl, aroyl, and trifluoroalkanoyl.

26. The method of claim 25, wherein R is straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each hydrogen.

27. The method of claim 26, wherein R is nonyl.

28. The method of claim 25, wherein R is straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each alkanoyl.

29. The method of claim 28, wherein R is nonyl.



30. The method of claim 29, wherein said alkanoyl is butanoyl.

31. The method of claim 25, wherein said *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound is selected from the group consisting of:

*N*-(*n*-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-octyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate  
*N*-(*n*-octyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;



*N*-(*n*-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;

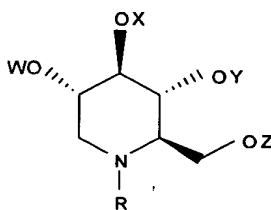


*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
*N*-(3-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(9-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
*N*-(3-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol; and  
*N*-(7,10,13-trioxa-n-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol.

32. The method of claim 25, wherein said pharmaceutically acceptable salt is selected from the group consisting of acetate, adipate, alginate, citrate, aspartate, benzoate, benzenesulfonate, bisulfate, butyrate, camphorate, camphorsulfonate, digluconate, cyclopentanepropionate, dodecylsulfate, ethanesulfonate, glucoheptanoate, glycerophosphate, hemisulfate, heptanoate, hexanoate, fumarate, hydrochloride, hydrobromide, hydroiodide, 2-hydroxy-ethanesulfonate, lactate, maleate, methanesulfonate, nicotinate, 2-naphthalenesulfonate, oxalate, palmoate, pectinate, persulfate, 3-phenylpropionate, picrate, pivalate, propionate, succinate, tartrate, thiocyanate, tosylate, mesylate, and undecanoate.



- 10 33. A method for treating a hepatitis virus infection in a mammal, consisting essentially of administering to said mammal an antiviral effective amount of an antiviral compound consisting essentially of at least one *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound of Formula I or a pharmaceutically acceptable salt thereof:



( I )

15 wherein R is selected from the group consisting of straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, branched chain alkyl having a chain length of C<sub>3</sub> to C<sub>20</sub> in the main chain, alkoxyalkyl, arylalkyl, and cycloalkylalkyl, and

20 wherein W, X, Y and Z are each independently selected from the group consisting of hydrogen, alkanoyl, aroyl, and trifluoroalkanoyl.

34. The method of claim 33, wherein R is straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each hydrogen.

35. The method of claim 34, wherein R is nonyl.

36. The method of claim 33, wherein R is straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each alkanoyl.

37. The method of claim 36, wherein R is nonyl.

38. The method of claim 37, wherein said alkanoyl is butanoyl.



39. The method of claim 33, wherein said *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound is selected from the group consisting of:

*N*-(*n*-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-octyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;

*N*-(*n*-octyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;

*N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;

*N*-(*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;

*N*-(*n*-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;

*N*-(*n*-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;

*N*-(*n*-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;

*N*-(*n*-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;

*N*-(*n*-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;

*N*-(*n*-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;

*N*-(*n*-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;

*N*-(*n*-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;

*N*-(*n*-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;



- 30 *N*-(n-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
35 *N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
40 *N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
45 *N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
50 *N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
55 *N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;

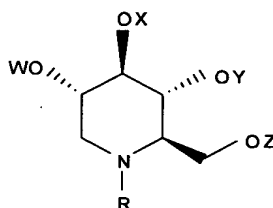


*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
*N*-(3-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(9-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
*N*-(3-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol; and  
*N*-(7,10,13-trioxa-n-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol.

40. The method of claim 33, wherein said pharmaceutically acceptable salt is selected from the group consisting of acetate, adipate, alginate, citrate, aspartate, benzoate, benzenesulfonate, bisulfate, butyrate, camphorate, camphorsulfonate, digluconate, cyclopentanepropionate, dodecylsulfate, ethanesulfonate, glucoheptanoate, glycerophosphate, hemisulfate, heptanoate, hexanoate, fumarate, hydrochloride, hydrobromide, hydroiodide, 2-hydroxy-ethanesulfonate, lactate, maleate, methanesulfonate, nicotinate, 2-naphthalenesulfonate, oxalate, palmoate, pectinate, persulfate, 3-phenylpropionate, picrate, pivalate, propionate, succinate, tartrate, thiocyanate, tosylate, mesylate, and undecanoate.



41. A method for treating a hepatitis virus infection in a mammal, consisting essentially of administering to said mammal a first amount of at least one *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound of Formula I or a pharmaceutically acceptable salt thereof:



(I)

wherein R is selected from the group consisting of straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, branched chain alkyl having a chain length of C<sub>3</sub> to C<sub>20</sub> in the main chain, alkoxyalkyl, arylalkyl, and cycloalkylalkyl, and

wherein W, X, Y and Z are each independently selected from the group consisting of hydrogen, alkanoyl, aroyl, and trifluoroalkanoyl; and

a second amount of an antiviral compound selected from the group consisting of a nucleoside antiviral compound, a nucleotide antiviral compound, an immunomodulator, an immunostimulant, and mixtures thereof,

wherein said first and second amounts of said compounds together comprise an anti-hepatitis virus effective amount of said compounds.

42. The method of claim 41, wherein R is straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each hydrogen.

42. The method of claim 42, wherein R is nonyl.

43. The method of claim 41, wherein R is straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each alkanoyl.



44. The method of claim 43, wherein R is nonyl.

45. The method of claim 44, wherein said alkanoyl is butanoyl.

46. The method of claim 41, wherein said *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound is selected from the group consisting of:

*N*-(*n*-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-octyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates

*N*-(*n*-octyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;

*N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;

*N*-(*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;

*N*-(*n*-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;

*N*-(*n*-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;

*N*-(*n*-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;

*N*-(*n*-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;

*N*-(*n*-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;

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*N*-(*n*-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(*n*-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(*n*-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(*n*-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(*n*-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;



- 55 *N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
60 *N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
65 *N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
70 *N*-(3-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(9-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
*N*-(3-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol; and  
75 *N*-(7,10,13-trioxa-n-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol.

46 847 = 19  
47. The method of claim 41, wherein said nucleoside or nucleotide antiviral compound is selected from the group consisting of:

- (+)-cis-5-fluoro-1-[2-(hydroxy-methyl)-[1,3-oxathiolan-5-yl]cytosine;  
(-)-2'-deoxy-3'-thiacytidine-5'-triphosphate (3TC);  
80 (-)-cis-5-fluoro-1-[2-(hydroxy-methyl)-[1,3-oxathiolan-5-yl]cytosine (FTC);  
(-)-2',3', dideoxy-3'-thiacytidine [(-)-SddC];  
1-(2'-deoxy-2'-fluoro-beta-D-arabinofuranosyl)-5-iodocytosine (FIAC);



1-(2'-deoxy-2'-fluoro-beta-D-arabinofuranosyl)-5-iodocytosine triphosphate  
(FIACTP);

- 85 1-(2'-deoxy-2'-fluoro-beta-D-arabinofuranosyl)-5-methyluracil (FMAU);  
1-beta-D-ribofuranosyl-1,2,4-triazole-3-carboxamide;  
2',3'-dideoxy-3'-fluoro-5-methyl-dexocytidine (FddMeCyt);  
2',3'-dideoxy-3'-chloro-5-methyl-dexocytidine (ClddMeCyt);  
2',3'-dideoxy-3'-amino-5-methyl-dexocytidine (AddMeCyt);  
90 2',3'-dideoxy-3'-fluoro-5-methyl-cytidine (FddMeCyt);  
2',3'-dideoxy-3'-chloro-5-methyl-cytidine (ClddMeCyt);  
2',3'-dideoxy-3'-amino-5-methyl-cytidine (AddMeCyt);  
2',3'-dideoxy-3'-fluorothymidine (FddThd);  
2',3'-dideoxy-beta-L-5-fluorocytidine (beta-L-FddC);  
95 2',3'-dideoxy-beta-L-5-thiacytidine;  
2',3'-dideoxy-beta-L-5-cytidine (beta-L-ddC);  
9-(1,3-dihydroxy-2-propoxymethyl)guanine;  
2'-deoxy-3'-thia-5-fluorocytosine;  
3'-amino-5-methyl-dexocytidine (AddMeCyt);  
100 2-amino-1,9-[(2-hydroxymethyl-1-(hydroxymethyl)ethoxy)methyl]-6H-purin-6-one  
(gancyclovir);  
2-[2-(2-amino-9H-purin-9y)ethyl]-1,3-propandil diacetate (famciclovir);  
2-amino-1,9-dihydro-9-[(2-hydroxy-ethoxy)methyl]6H-purin-6-one (acyclovir);  
9-(4-hydroxy-3-hydroxymethyl-but-1-yl)guanine (penciclovir);  
105 9-(4-hydroxy-3-hydroxymethyl-but-1-yl)-6-deoxy-guanine, diacetate (famciclovir);  
3'-azido-3'-deoxythymidine (AZT);  
3'-chloro-5-methyl-dexocytidine (ClddMeCyt);  
9-(2-phosphonyl-methoxyethyl)-2',6'-diaminopurine-2',3'-dideoxyriboside;  
9-(2-phosphonylmethoxyethyl)adenine (PMEA);  
110 acyclovir triphosphate (ACVTP);  
D-carbocyclic-2'-deoxyguanosine (CdG);



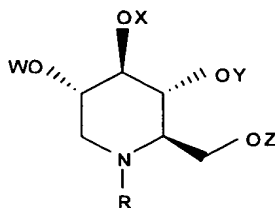
dideoxy-cytidine;  
dideoxy-cytosine (ddC);  
dideoxy-guanine (ddG);  
115 dideoxy-inosine (ddI);  
E-5-(2-bromovinyl)-2'-deoxyuridine triphosphate;  
fluoro-arabinofuranosyl-iodouracil;  
1-(2'-deoxy-2'-fluoro-1-beta-D-arabinofuranosyl)-5-iodo-uracil (FIAU);  
stavudine;  
120 9-beta-D-arabinofuranosyl-9H-purine-6-amine monohydrate (Ara-A);  
9-beta-D-arabinofuranosyl-9H-purine-6-amine-5'-monophosphate monohydrate  
(Ara-AMP);  
2-deoxy-3'-thia-5-fluorocytidine;  
2',3'-dideoxy-guanine; and  
125 2',3'-dideoxy-guanosine.

48. The method of claim 41, wherein said *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound is selected from the group consisting of *N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol or a pharmaceutically acceptable salt thereof, *N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates or a pharmaceutically acceptable salt thereof, and mixtures thereof; and

5 wherein said nucleoside or nucleotide antiviral compound is (-)-2'-deoxy-3'-thiocytidine-5'-triphosphate (3TC).

4319625 49. A method for treating a hepatitis B virus infection in a mammal, comprising administering to said mammal from about 0.1 mg/kg/day to about 100 mg/kg/day of at least one *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound of Formula I or a pharmaceutically acceptable salt thereof: ✓





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(I)

wherein R is selected from the group consisting of straight chain alkyl having a chain length of  $C_7$  to  $C_{20}$ , branched chain alkyl having a chain length of  $C_3$  to  $C_{20}$  in the main chain, alkoxyalkyl, arylalkyl, and cycloalkylalkyl, and

wherein W, X, Y and Z are each independently selected from the group consisting of hydrogen, alkanoyl, aroyl, and trifluoroalkanoyl; and

from about 0.1 mg/person/day to about 500 mg/person/day of a compound selected from the group consisting of a nucleoside antiviral compound, a nucleotide antiviral compound, and a mixture thereof.

50. The method of claim 49, wherein R is straight chain alkyl having a chain length of  $C_7$  to  $C_{20}$ , and W, X, Y, and Z are each hydrogen.

51. The method of claim 50, wherein R is nonyl.

52. The method of claim 49, wherein R is straight chain alkyl having a chain length of  $C_7$  to  $C_{20}$ , and W, X, Y, and Z are each alkanoyl.

53. The method of claim 52, wherein R is nonyl.

54. The method of claim 53, wherein said alkanoyl is butanoyl.



55. The method of claim 49, wherein said *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound is selected from the group consisting of:

*N*-(*n*-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-octyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(*n*-octyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(*n*-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(*n*-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(*n*-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(*n*-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(*n*-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(*n*-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(*n*-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(*n*-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(*n*-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;

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- 30 *N*-(n-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
35 *N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
40 *N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
45 *N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
50 *N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
55 *N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;



*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
*N*-(3-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(9-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
*N*-(3-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol; and  
*N*-(7,10,13-trioxa-n-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol.

56. The method of claim 49, wherein said nucleoside or nucleotide antiviral compound is selected from the group consisting of:

(+)-cis-5-fluoro-1-[2-(hydroxy-methyl)-[1,3-oxathiolan-5-yl]cytosine;  
(-)-2'-deoxy-3'-thiacytidine-5'-triphosphate (3TC);  
(-)-cis-5-fluoro-1-[2-(hydroxy-methyl)-[1,3-oxathiolan-5-yl]cytosine (FTC);  
(-)-2',3', dideoxy-3'-thiacytidine [(-)-SddC];  
1-(2'-deoxy-2'-fluoro-beta-D-arabinofuranosyl)-5-iodocytosine (FIAC);  
1-(2'-deoxy-2'-fluoro-beta-D-arabinofuranosyl)-5-iodocytosine triphosphate (FIACTP);  
1-(2'-deoxy-2'-fluoro-beta-D-arabinofuranosyl)-5-methyluracil (FMAU);  
1-beta-D-ribofuranosyl-1,2,4-triazole-3-carboxamide;



2',3'-dideoxy-3'-fluoro-5-methyl-dexocytidine (FddMeCyt);  
2',3'-dideoxy-3'-chloro-5-methyl-dexocytidine (ClddMeCyt);  
2',3'-dideoxy-3'-amino-5-methyl-dexocytidine (AddMeCyt);  
15 2',3'-dideoxy-3'-fluoro-5-methyl-cytidine (FddMeCyt);  
2',3'-dideoxy-3'-chloro-5-methyl-cytidine (ClddMeCyt);  
2',3'-dideoxy-3'-amino-5-methyl-cytidine (AddMeCyt);  
2',3'-dideoxy-3'-fluorothymidine (FddThd);  
2',3'-dideoxy-beta-L-5-fluorocytidine (beta-L-FddC);  
20 2',3'-dideoxy-beta-L-5-thiacytidine;  
2',3'-dideoxy-beta-L-5-cytidine (beta-L-ddC);  
9-(1,3-dihydroxy-2-propoxymethyl)guanine;  
2'-deoxy-3'-thia-5-fluorocytosine;  
3'-amino-5-methyl-dexocytidine (AddMeCyt);  
25 2-amino-1,9-[(2-hydroxymethyl-1-(hydroxymethyl)ethoxy)methyl]-6H-purin-6-one  
(gancyclovir);  
2-[2-(2-amino-9H-purin-9y)ethyl]-1,3-propandil diacetate (famciclovir);  
2-amino-1,9-dihydro-9-[(2-hydroxy-ethoxy)methyl]6H-purin-6-one (acyclovir);  
9-(4-hydroxy-3-hydroxymethyl-but-1-yl)guanine (penciclovir);  
30 9-(4-hydroxy-3-hydroxymethyl-but-1-yl)-6-deoxy-guanine, diacetate (famciclovir);  
3'-azido-3'-deoxythymidine (AZT);  
3'-chloro-5-methyl-dexocytidine (ClddMeCyt);  
9-(2-phosphonyl-methoxyethyl)-2',6'-diaminopurine-2',3'-dideoxyriboside;  
9-(2-phosphonylmethoxyethyl)adenine (PMEA);  
35 acyclovir triphosphate (ACVTP);  
D-carbocyclic-2'-deoxyguanosine (CdG);  
dideoxy-cytidine;  
dideoxy-cytosine (ddC);  
dideoxy-guanine (ddG);  
40 dideoxy-inosine (ddI);



E-5-(2-bromovinyl)-2'-deoxyuridine triphosphate;

fluoro-arabinofuranosyl-iodouracil;

1-(2'-deoxy-2'-fluoro-1-beta-D-arabinofuranosyl)-5-iodo-uracil (FIAU);

stavudine;

9-beta-D-arabinofuranosyl-9H-purine-6-amine monohydrate (Ara-A);

9-beta-D-arabinofuranosyl-9H-purine-6-amine-5'-monophosphate monohydrate  
(Ara-AMP);

2-deoxy-3'-thia-5-fluorocytidine;

2',3'-dideoxy-guanine; and

2',3'-dideoxy-guanosine.

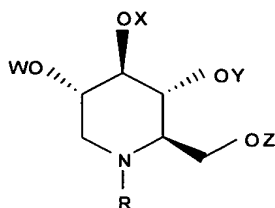
57. The method of claim 49, wherein said *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound is selected from the group consisting of *N*-(n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol or a pharmaceutically acceptable salt thereof, *N*-(n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates or a pharmaceutically acceptable salt thereof, and mixtures thereof; and

wherein said nucleoside or nucleotide antiviral compound is (-)-2'-deoxy-3'-thiocytidine-5'-triphosphate (3TC).

34 ← 58. A method for treating a hepatitis B virus infection in a human patient, comprising administering to said human patient from about 0.1 mg/kg/day to about 100 mg/kg/day of an *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound selected from the group consisting *N*-(n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol or a pharmaceutically acceptable salt thereof, *N*-(n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates or a pharmaceutically acceptable salt thereof, and mixtures thereof, and from about 0.1 mg/person/day to about 500 mg/person/day of (-)-2'-deoxy-3'-thiocytidine-5'-triphosphate. ✓



59. A method for treating a hepatitis virus infection in a mammal, comprising administering to said mammal an antiviral effective amount of at least one *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound of Formula I or a pharmaceutically acceptable salt thereof:



(I)

substantially exclusive of the administration of an antiviral composition comprising a nucleoside, a nucleotide, an immunomodulator, or an immunostimulant,

wherein R is selected from the group consisting of straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, branched chain alkyl having a chain length of C<sub>3</sub> to C<sub>20</sub> in the main chain, alkoxyalkyl, arylalkyl, and cycloalkylalkyl, and

wherein W, X, Y and Z are each independently selected from the group consisting of hydrogen, alkanoyl, aroyl, and trifluoroalkanoyl.

60. The method of claim 59, further comprising administering said at least one *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound of Formula I or pharmaceutically acceptable salt thereof in combination with a pharmaceutically acceptable carrier, excipient, or diluent.

61. The method of claim 59, wherein R is straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each hydrogen.

62. The method of claim 61, wherein R is nonyl.



63. The method of claim 59, wherein R is straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each alkanoyl.

64. The method of claim 63, wherein R is nonyl.

65. The method of claim 64, wherein said alkanoyl is butanoyl.

66. The method of claim 59, wherein said *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound is selected from the group consisting of:

*N*-(*n*-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-octyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate  
*N*-(*n*-octyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;



*N*-(*n*-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(*n*-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
25 *N*-(*n*-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(*n*-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(*n*-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(*n*-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(*n*-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
30 *N*-(*n*-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
35 *N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
40 *N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
45 *N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
50 *N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;



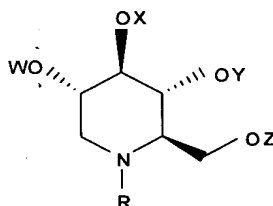
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
*N*-(3-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(9-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
*N*-(3-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol; and  
*N*-(7,10,13-trioxa-n-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol.

67. The method of claim 59, wherein said pharmaceutically acceptable salt is selected from the group consisting of acetate, adipate, alginate, citrate, aspartate, benzoate, benzenesulfonate, bisulfate, butyrate, camphorate, camphorsulfonate, digluconate, cyclopentanepropionate, dodecylsulfate, ethanesulfonate, glucoheptanoate,



glycerophosphate, hemisulfate, heptanoate, hexanoate, fumarate, hydrochloride, hydrobromide, hydroiodide, 2-hydroxy-ethanesulfonate, lactate, maleate, methanesulfonate, nicotinate, 2-naphthalenesulfonate, oxalate, palmoate, pectinate, persulfate, 3-phenylpropionate, picrate, pivalate, propionate, succinate, tartrate, thiocyanate, tosylate, mesylate, and undecanoate.

68. A method for treating a hepatitis virus infection in a mammal, comprising administering to said mammal an antiviral effective amount of at least one *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound of Formula I or a pharmaceutically acceptable salt thereof:



(I)

substantially exclusive of the administration of antiviral compounds other than compounds of Formula I,

wherein R is selected from the group consisting of straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, branched chain alkyl having a chain length of C<sub>3</sub> to C<sub>20</sub> in the main chain, alkoxyalkyl, arylalkyl, and cycloalkylalkyl, and

wherein W, X, Y and Z are each independently selected from the group consisting of hydrogen, alkanoyl, aroyl, and trifluoroalkanoyl.

69. The method of claim 68, further comprising administering said at least one *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound of Formula I or



pharmaceutically acceptable salt thereof in combination with a pharmaceutically acceptable carrier, excipient, or diluent.

70. The method of claim 68, wherein R is straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each hydrogen.

71. The method of claim 70, wherein R is nonyl.

72. The method of claim 68, wherein R is straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each alkanoyl.

73. The method of claim 72, wherein R is nonyl.

74. The method of claim 73, wherein said alkanoyl is butanoyl.

75. The method of claim 68, wherein said *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound is selected from the group consisting of:

*N*-(*n*-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-octyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;



- 15            *N*-(*n*-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(*n*-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(*n*-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate  
              *N*-(*n*-octyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
20            *N*-(*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(*n*-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(*n*-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(*n*-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(*n*-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
25            *N*-(*n*-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(*n*-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(*n*-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(*n*-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(*n*-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
30            *N*-(*n*-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
35            *N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
40            *N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol;



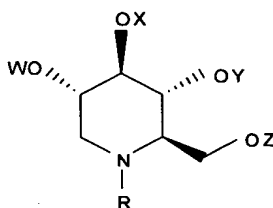
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*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
*N*-(3-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(9-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;



*N*-(3-oxa-*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
*N*-(3-oxa-*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol; and  
*N*-(7,10,13-trioxa-*n*-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol.

76. The method of claim 68, wherein said pharmaceutically acceptable salt is selected from the group consisting of acetate, adipate, alginate, citrate, aspartate, benzoate, benzenesulfonate, bisulfate, butyrate, camphorate, camphorsulfonate, digluconate, cyclopentanepropionate, dodecylsulfate, ethanesulfonate, glucoheptanoate, glycerophosphate, hemisulfate, heptanoate, hexanoate, fumarate, hydrochloride, hydrobromide, hydroiodide, 2-hydroxy-ethanesulfonate, lactate, maleate, methanesulfonate, nicotinate, 2-naphthalenesulfonate, oxalate, palmoate, pectinate, persulfate, 3-phenylpropionate, picrate, pivalate, propionate, succinate, tartrate, thiocyanate, tosylate, mesylate, and undecanoate.

77. A pharmaceutical composition, comprising an antiviral effective amount of at least one *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound of Formula I or a pharmaceutically acceptable salt thereof: ✓



( I )

wherein R is selected from the group consisting of straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, branched chain alkyl having a chain length of C<sub>3</sub> to C<sub>20</sub> in the main chain, alkoxyalkyl, arylalkyl, and cycloalkylalkyl, and

wherein W, X, Y and Z are each independently selected from the group consisting of hydrogen, alkanoyl, aroyl, and trifluoroalkanoyl; and



*N*-(n-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;



- 15            *N*-(n-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(n-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(n-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate  
              *N*-(n-octyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
20            *N*-(n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(n-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(n-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(n-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(n-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
25            *N*-(n-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(n-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(n-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(n-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(n-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
30            *N*-(n-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
              *N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
35            *N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
40            *N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol;



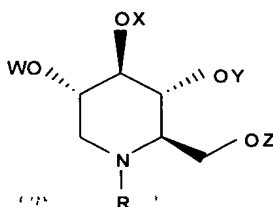
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
*N*-(3-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(9-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;



*N*-(3-oxa-*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
*N*-(3-oxa-*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol; and  
*N*-(7,10,13-trioxa-*n*-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol.

84. The pharmaceutical composition of claim 77, wherein said pharmaceutically acceptable salt is selected from the group consisting of acetate, adipate, alginate, citrate, aspartate, benzoate, benzenesulfonate, bisulfate, butyrate, camphorate, camphorsulfonate, digluconate, cyclopentanepropionate, dodecylsulfate, ethanesulfonate, glucoheptanoate, glycerophosphate, hemisulfate, heptanoate, hexanoate, fumarate, hydrochloride, hydrobromide, hydroiodide, 2-hydroxy-ethanesulfonate, lactate, maleate, methanesulfonate, nicotinate, 2-naphthalenesulfonate, oxalate, palmoate, pectinate, persulfate, 3-phenylpropionate, picrate, pivalate, propionate, succinate, tartrate, thiocyanate, tosylate, mesylate, and undecanoate.

85. A pharmaceutical composition, consisting essentially of an antiviral effective amount of at least one *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound of Formula I or a pharmaceutically acceptable salt thereof: ✓



(I)

wherein R is selected from the group consisting of straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, branched chain alkyl having a chain length of C<sub>3</sub> to C<sub>20</sub> in the main chain, alkoxyalkyl, arylalkyl, and cycloalkylalkyl, and



10                wherein W, X, Y and Z are each independently selected from the group consisting  
of hydrogen, alkanoyl, aroyl, and trifluoroalkanoyl; and  
a pharmaceutically acceptable carrier, diluent, or excipient.

86. The pharmaceutical composition of claim 85, wherein R is straight chain alkyl  
having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each hydrogen.

87. The pharmaceutical composition of claim 86, wherein R is nonyl.

88. The pharmaceutical composition of claim 85, wherein R is straight chain alkyl  
having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each alkanoyl.

89. The pharmaceutical composition of claim 88, wherein R is nonyl.

90. The pharmaceutical composition of claim 89, wherein said alkanoyl is  
butanoyl.

91. The pharmaceutical composition of claim 85, wherein said *N*-substituted-1,5-  
dideoxy-1,5-imino-D-glucitol compound is selected from the group consisting of:

*N*-(*n*-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-octyl)-1,5-dideoxy-1,5-imino-D-glucitol;

5                *N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

10                *N*-(*n*-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;



*N*-(*n*-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
15 *N*-(*n*-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate  
*N*-(*n*-octyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
20 *N*-(*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
25 *N*-(*n*-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
30 *N*-(*n*-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
35 *N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
40 *N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;



*N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
*N*-(3-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;

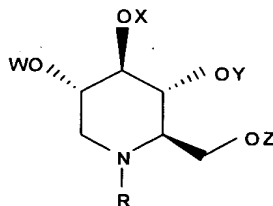


*N*-(9-oxa-*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-oxa-*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-oxa-*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
*N*-(3-oxa-*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol; and  
*N*-(7,10,13-trioxa-*n*-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol.

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92. The method of claim 85, wherein said pharmaceutically acceptable salt is selected from the group consisting of acetate, adipate, alginate, citrate, aspartate, benzoate, benzenesulfonate, bisulfate, butyrate, camphorate, camphorsulfonate, digluconate, cyclopentanepropionate, dodecylsulfate, ethanesulfonate, glucoheptanoate, glycerophosphate, hemisulfate, heptanoate, hexanoate, fumarate, hydrochloride, hydrobromide, hydroiodide, 2-hydroxy-ethanesulfonate, lactate, maleate, methanesulfonate, nicotinate, 2-naphthalenesulfonate, oxalate, palmoate, pectinate, persulfate, 3-phenylpropionate, picrate, pivalate, propionate, succinate, tartrate, thiocyanate, tosylate, mesylate, and undecanoate.

93. A pharmaceutical composition, comprising an antiviral effective amount of at least one *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound of Formula I or a pharmaceutically acceptable salt thereof: ✓



(I)

substantially free of a nucleoside, nucleotide, immunomodulator, or immunostimulant,



10 wherein R is selected from the group consisting of straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, branched chain alkyl having a chain length of C<sub>3</sub> to C<sub>20</sub> in the main chain, alkoxyalkyl, arylalkyl, and cycloalkylalkyl, and

wherein W, X, Y and Z are each independently selected from the group consisting of hydrogen, alkanoyl, aroyl, and trifluoroalkanoyl; and

a pharmaceutically acceptable, carrier, diluent, or excipient.

94. The pharmaceutical composition of claim 93, wherein R is straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each hydrogen.

95. The pharmaceutical composition of claim 94, wherein R is nonyl.

96. The pharmaceutical composition of claim 93, wherein R is straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each alkanoyl.

97. The pharmaceutical composition of claim 96, wherein R is nonyl.

98. The pharmaceutical composition of claim 97, wherein said alkanoyl is butanoyl.

99. The pharmaceutical composition of claim 93, wherein said *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound is selected from the group consisting of:

*N*-(*n*-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-octyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol;



- 10 *N*-(n-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
15 *N*-(n-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate  
*N*-(n-octyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
20 *N*-(n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
25 *N*-(n-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
30 *N*-(n-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
35 *N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol;



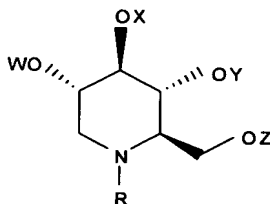
*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;



*N*-(7-oxa-*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(7-oxa-*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
*N*-(3-oxa-*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(9-oxa-*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-oxa-*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-oxa-*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
*N*-(3-oxa-*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol; and  
*N*-(7,10,13-trioxa-*n*-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol.

100. The pharmaceutical composition of claim 93, wherein said pharmaceutically acceptable salt is selected from the group consisting of acetate, adipate, alginate, citrate, aspartate, benzoate, benzenesulfonate, bisulfate, butyrate, camphorate, camphorsulfonate, digluconate, cyclopentanepropionate, dodecylsulfate, ethanesulfonate, glucoheptanoate, glycerophosphate, hemisulfate, heptanoate, hexanoate, fumarate, hydrochloride, hydrobromide, hydroiodide, 2-hydroxy-ethanesulfonate, lactate, maleate, methanesulfonate, nicotinate, 2-naphthalenesulfonate, oxalate, palmoate, pectinate, persulfate, 3-phenylpropionate, picrate, pivalate, propionate, succinate, tartrate, thiocyanate, tosylate, mesylate, and undecanoate.

101. A pharmaceutical composition, comprising an antiviral effective amount of at least one *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound of Formula I or a pharmaceutically acceptable salt thereof:





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( I )

substantially free of antiviral compounds other than compounds of Formula I,  
wherein R is selected from the group consisting of straight chain alkyl having a  
chain length of C<sub>7</sub> to C<sub>20</sub>, branched chain alkyl having a chain length of C<sub>3</sub> to C<sub>20</sub> in the  
main chain, alkoxyalkyl, arylalkyl, and cycloalkylalkyl, and

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wherein W, X, Y and Z are each independently selected from the group consisting  
of hydrogen, alkanoyl, aroyl, and trifluoroalkanoyl; and  
a pharmaceutically acceptable, carrier, diluent, or excipient.

102. The pharmaceutical composition of claim 101, wherein R is straight chain  
alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each hydrogen.

103. The pharmaceutical composition of claim 102, wherein R is nonyl.

104. The pharmaceutical composition of claim 101, wherein R is straight chain  
alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each alkanoyl.

105. The pharmaceutical composition of claim 104, wherein R is nonyl.

106. The pharmaceutical composition of claim 105, wherein said alkanoyl is  
butanoyl.

107. The pharmaceutical composition of claim 101, wherein said *N*-substituted-  
1,5-dideoxy-1,5-imino-D-glucitol compound is selected from the group consisting of:

*N*-(*n*-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-octyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

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*N*-(*n*-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate  
*N*-(*n*-octyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;



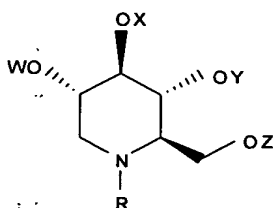
*N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;



*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
*N*-(3-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(9-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
*N*-(3-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol; and  
*N*-(7,10,13-trioxa-n-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol.

108. The pharmaceutical composition of claim 101, wherein said pharmaceutically acceptable salt is selected from the group consisting of acetate, adipate, alginate, citrate, aspartate, benzoate, benzenesulfonate, bisulfate, butyrate, camphorate, camphorsulfonate, digluconate, cyclopentanepropionate, dodecylsulfate, ethanesulfonate, glucoheptanoate, glycerophosphate, hemisulfate, heptanoate, hexanoate, fumarate, hydrochloride, hydrobromide, hydroiodide, 2-hydroxy-ethanesulfonate, lactate, maleate, methanesulfonate, nicotinate, 2-naphthalenesulfonate, oxalate, palmoate, pectinate, persulfate, 3-phenylpropionate, picrate, pivalate, propionate, succinate, tartrate, thiocyanate, tosylate, mesylate, and undecanoate.

35 — 109. A composition, comprising at least one *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound of Formula I or a pharmaceutically acceptable salt thereof: ✓





*N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;



*N*-(*n*-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate  
*N*-(*n*-octyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;



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( I )

wherein R is selected from the group consisting of straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, branched chain alkyl having a chain length of C<sub>3</sub> to C<sub>20</sub> in the main chain, alkoxyalkyl, arylalkyl, and cycloalkylalkyl, and

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wherein W, X, Y and Z are each independently selected from the group consisting of hydrogen, alkanoyl, aroyl, and trifluoroalkanoyl; and

an antiviral compound selected from the group consisting of a nucleoside antiviral compound, a nucleotide antiviral compound, an immunomodulator, an immunostimulant, and mixtures thereof.

110. The composition of claim 109, wherein R is straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each hydrogen.

111. The composition of claim 110, wherein R is nonyl.

112. The composition of claim 109, wherein R is straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each alkanoyl.

113. The composition of claim 112, wherein R is nonyl.

114. The composition of claim 113, wherein said alkanoyl is butanoyl.

115. The composition of claim 109, wherein said *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound is selected from the group consisting of:

*N*-(*n*-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-octyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

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*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
*N*-(3-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(9-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
*N*-(3-oxa-n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol; and  
*N*-(7,10,13-trioxa-n-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol.

116. The composition of claim 109, wherein said nucleoside or nucleotide antiviral compound is selected from the group consisting of:

(+)-cis-5-fluoro-1-[2-(hydroxy-methyl)-[1,3-oxathiolan-5-yl]cytosine;  
(-)-2'-deoxy-3'-thiocytidine-5'-triphosphate (3TC);  
(-)-cis-5-fluoro-1-[2-(hydroxy-methyl)-[1,3-oxathiolan-5-yl]cytosine (FTC);  
(-)-2',3', dideoxy-3'-thiacytidine [(-)-SddC];  
1-(2'-deoxy-2'-fluoro-beta-D-arabinofuranosyl)-5-iodocytosine (FIAC);  
1-(2'-deoxy-2'-fluoro-beta-D-arabinofuranosyl)-5-iodocytosine triphosphate (FIACTP);  
1-(2'-deoxy-2'-fluoro-beta-D-arabinofuranosyl)-5-methyluracil (FMAU);  
1-beta-D-ribofuranosyl-1,2,4-triazole-3-carboxamide;  
2',3'-dideoxy-3'-fluoro-5-methyl-dexocytidine (FddMeCyt);  
2',3'-dideoxy-3'-chloro-5-methyl-dexocytidine (CliddMeCyt);  
2',3'-dideoxy-3'-amino-5-methyl-dexocytidine (AddMeCyt);  
2',3'-dideoxy-3'-fluoro-5-methyl-cytidine (FddMeCyt);  
2',3'-dideoxy-3'-chloro-5-methyl-cytidine (CliddMeCyt);  
2',3'-dideoxy-3'-amino-5-methyl-cytidine (AddMeCyt);  
2',3'-dideoxy-3'-fluorothymidine (FddThd);



20 2',3'-dideoxy-beta-L-5-fluorocytidine (beta-L-FddC);  
2',3'-dideoxy-beta-L-5-thiacytidine;  
2',3'-dideoxy-beta-L-5-cytidine (beta-L-ddC);  
9-(1,3-dihydroxy-2-propoxymethyl)guanine;  
2'-deoxy-3'-thia-5-fluorocytosine;  
3'-amino-5-methyl-dexocytidine (AddMeCyt);  
25 2-amino-1,9-[(2-hydroxymethyl-1-(hydroxymethyl)ethoxy)methyl]-6H-purin-6-one  
(gancyclovir);  
2-[2-(2-amino-9H-purin-9y)ethyl]-1,3-propandil diacetate (famciclovir);  
2-amino-1,9-dihydro-9-[(2-hydroxy-ethoxy)methyl]6H-purin-6-one (acyclovir);  
9-(4-hydroxy-3-hydroxymethyl-but-1-yl)guanine (penciclovir);  
30 9-(4-hydroxy-3-hydroxymethyl-but-1-yl)-6-deoxy-guanine, diacetate (famciclovir);  
3'-azido-3'-deoxythymidine (AZT);  
3'-chloro-5-methyl-dexocytidine (ClddMeCyt);  
9-(2-phosphonyl-methoxyethyl)-2',6'-diaminopurine-2',3'-dideoxyriboside;  
9-(2-phosphonylmethoxyethyl)adenine (PMEA);  
35 acyclovir triphosphate (ACVTP);  
D-carbocyclic-2'-deoxyguanosine (CdG);  
dideoxy-cytidine;  
dideoxy-cytosine (ddC);  
dideoxy-guanine (ddG);  
40 dideoxy-inosine (ddI);  
E-5-(2-bromovinyl)-2'-deoxyuridine triphosphate;  
fluoro-arabinofuranosyl-iodouracil;  
1-(2'-deoxy-2'-fluoro-1-beta-D-arabinofuranosyl)-5-iodo-uracil (FIAU);  
stavudine;  
45 9-beta-D-arabinofuranosyl-9H-purine-6-amine monohydrate (Ara-A);  
9-beta-D-arabinofuranosyl-9H-purine-6-amine-5'-monophosphate monohydrate  
(Ara-AMP);



2-deoxy-3'-thia-5-fluorocytidine;  
2',3'-dideoxy-guanine; and  
2',3'-dideoxy-guanosine.

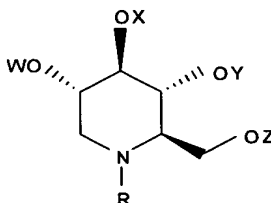
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117. The composition of claim 109, wherein said *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound is selected from the group consisting of *N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol or a pharmaceutically acceptable salt thereof, *N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate or a pharmaceutically acceptable salt thereof, and mixtures thereof; and

wherein said nucleoside or nucleotide antiviral compound is (-)-2'-deoxy-3'-thiocytidine-5'-triphosphate (3TC).

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118. A pharmaceutical composition, comprising:  
a first amount of at least one *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound of Formula I or a pharmaceutically acceptable salt thereof:



( I )

wherein R is selected from the group consisting of straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, branched chain alkyl having a chain length of C<sub>3</sub> to C<sub>20</sub> in the main chain, alkoxyalkyl, arylalkyl, and cycloalkylalkyl, and

wherein W, X, Y and Z are each independently selected from the group consisting of hydrogen, alkanoyl, aroyl, and trifluoroalkanoyl;

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a second amount of an antiviral compound selected from the group consisting of a nucleoside antiviral compound, a nucleotide antiviral compound, an immunomodulator, and immunostimulant, and mixtures thereof; and

15

a pharmaceutically acceptable carrier, diluent, or excipient,

wherein said first and second amounts of said compounds together comprise an antiviral effective amount of said compounds.

119. The pharmaceutical composition of claim 118, wherein R is straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each hydrogen.

120. The pharmaceutical composition of claim 119, wherein R is nonyl.

121. The pharmaceutical composition of claim 118, wherein R is straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each alkanoyl.

122. The pharmaceutical composition of claim 121, wherein R is nonyl.

123. The pharmaceutical composition of claim 122, wherein said alkanoyl is butanoyl.

124. The pharmaceutical composition of claim 118, wherein said *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound is selected from the group consisting of:

*N*-(*n*-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-octyl)-1,5-dideoxy-1,5-imino-D-glucitol;

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*N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol;



- 10 *N*-(n-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
15 *N*-(n-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate  
*N*-(n-octyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
20 *N*-(n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
25 *N*-(n-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
30 *N*-(n-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
35 *N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol;



*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(7-oxa-*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;



*N*-(7-oxa-*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(7-oxa-*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
*N*-(3-oxa-*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(9-oxa-*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-oxa-*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-oxa-*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
*N*-(3-oxa-*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol; and  
*N*-(7,10,13-trioxa-*n*-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol.

125. The pharmaceutical composition of claim 118, wherein said nucleoside or nucleotide antiviral compound is selected from the group consisting of:

(+)-cis-5-fluoro-1-[2-(hydroxy-methyl)-[1,3-oxathiolan-5-yl]cytosine;  
(-)-2'-deoxy-3'-thiocytidine-5'-triphosphate (3TC);  
(-)-cis-5-fluoro-1-[2-(hydroxy-methyl)-[1,3-oxathiolan-5-yl]cytosine (FTC);  
(-)-2',3', dideoxy-3'-thiacytidine [(-)-SddC];  
1-(2'-deoxy-2'-fluoro-beta-D-arabinofuranosyl)-5-iodocytosine (FIAC);  
1-(2'-deoxy-2'-fluoro-beta-D-arabinofuranosyl)-5-iodocytosine triphosphate (FIACTP);  
1-(2'-deoxy-2'-fluoro-beta-D-arabinofuranosyl)-5-methyluracil (FMAU);  
1-beta-D-ribofuranosyl-1,2,4-triazole-3-carboxamide;  
2',3'-dideoxy-3'-fluoro-5-methyl-dexocytidine (FddMeCyt);  
2',3'-dideoxy-3'-chloro-5-methyl-dexocytidine (ClddMeCyt);  
2',3'-dideoxy-3'-amino-5-methyl-dexocytidine (AddMeCyt);  
2',3'-dideoxy-3'-fluoro-5-methyl-cytidine (FddMeCyt);  
2',3'-dideoxy-3'-chloro-5-methyl-cytidine (ClddMeCyt);  
2',3'-dideoxy-3'-amino-5-methyl-cytidine (AddMeCyt);  
2',3'-dideoxy-3'-fluorothymidine (FddThd);  
2',3'-dideoxy-beta-L-5-fluorocytidine (beta-L-FddC);  
2',3'-dideoxy-beta-L-5-thiacytidine;



2',3'-dideoxy-beta-L-5-cytidine (beta-L-ddC);  
9-(1,3-dihydroxy-2-propoxymethyl)guanine;  
2'-deoxy-3'-thia-5-fluorocytosine;  
3'-amino-5-methyl-dexocytidine (AddMeCyt);  
25 2-amino-1,9-[(2-hydroxymethyl-1-(hydroxymethyl)ethoxy)methyl]-6H-purin-6-one  
(gancyclovir);  
2-[2-(2-amino-9H-purin-9y)ethyl]-1,3-propandil diacetate (famciclovir);  
2-amino-1,9-dihydro-9-[(2-hydroxy-ethoxy)methyl]6H-purin-6-one (acyclovir);  
9-(4-hydroxy-3-hydroxymethyl-but-1-yl)guanine (penciclovir);  
30 9-(4-hydroxy-3-hydroxymethyl-but-1-yl)-6-deoxy-guanine, diacetate (famciclovir);  
3'-azido-3'-deoxythymidine (AZT);  
3'-chloro-5-methyl-dexocytidine (ClddMeCyt);  
9-(2-phosphonyl-methoxyethyl)-2',6'-diaminopurine-2',3'-dideoxyriboside;  
9-(2-phosphonylmethoxyethyl)adenine (PMEA);  
35 acyclovir triphosphate (ACVTP);  
D-carbocyclic-2'-deoxyguanosine (CdG);  
dideoxy-cytidine;  
dideoxy-cytosine (ddC);  
dideoxy-guanine (ddG);  
40 dideoxy-inosine (ddI);  
E-5-(2-bromovinyl)-2'-deoxyuridine triphosphate;  
fluoro-arabinofuranosyl-iodouracil;  
1-(2'-deoxy-2'-fluoro-1-beta-D-arabinofuranosyl)-5-iodo-uracil (FIAU);  
stavudine;  
45 9-beta-D-arabinofuranosyl-9H-purine-6-amine monohydrate (Ara-A);  
9-beta-D-arabinofuranosyl-9H-purine-6-amine-5'-monophosphate monohydrate  
(Ara-AMP);  
2-deoxy-3'-thia-5-fluorocytidine;  
2',3'-dideoxy-guanine; and



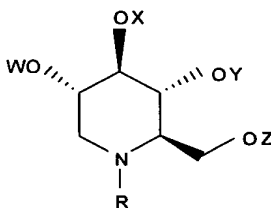
50 2',3'-dideoxy-guanosine.

126. The pharmaceutical composition of claim 118, wherein said *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound is selected from the group consisting of *N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol or a pharmaceutically acceptable salt thereof, *N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates or a pharmaceutically acceptable salt thereof, and mixtures thereof; and

wherein said nucleoside or nucleotide antiviral compound is (-)-2'-deoxy-3'-thiocytidine-5'-triphosphate (3TC).

66 ← 127. A pharmaceutical composition for treating a hepatitis B virus infection in a mammal, comprising:

from about 0.1 mg to about 100 mg of at least one *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound of Formula I or a pharmaceutically acceptable salt thereof:



(I)

10 wherein R is selected from the group consisting of straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, branched chain alkyl having a chain length of C<sub>3</sub> to C<sub>20</sub> in the main chain, alkoxyalkyl, arylalkyl, and cycloalkylalkyl, and

wherein W, X, Y and Z are each independently selected from the group consisting of hydrogen, alkanoyl, aroyl, and trifluoroalkanoyl;



from about 0.1 mg to about 500 mg of a compound selected from the group consisting of a nucleoside antiviral compound, a nucleotide antiviral, and mixtures thereof; and

a pharmaceutically acceptable carrier, diluent, or excipient.

128. The pharmaceutical composition of claim 127, wherein R is straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each hydrogen.

129. The pharmaceutical composition of claim 128, wherein R is nonyl.

130. The pharmaceutical composition of claim 127, wherein R is straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each alkanoyl.

131. The pharmaceutical composition of claim 130, wherein R is nonyl.

132. The pharmaceutical composition of claim 131, wherein said alkanoyl is butanoyl.

133. The pharmaceutical composition of claim 127, wherein said *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound is selected from the group consisting of:

*N*-(*n*-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-octyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;



*N*-(*n*-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(*n*-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate  
*N*-(*n*-octyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(*n*-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol;



*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
45 *N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
50 *N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
55 *N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
60 *N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
65 *N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;



70           *N*-(3-oxa-*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(9-oxa-*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(7-oxa-*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
              *N*-(3-oxa-*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
              *N*-(3-oxa-*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol; and  
75           *N*-(7,10,13-trioxa-*n*-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol.

134. The pharmaceutical composition of claim 127, wherein said nucleoside or nucleotide antiviral compound is selected from the group consisting of:

(+)-cis-5-fluoro-1-[2-(hydroxy-methyl)-[1,3-oxathiolan-5-yl]cytosine;  
(-)-2'-deoxy-3'-thiacytidine-5'-triphosphate (3TC);  
(-)-cis-5-fluoro-1-[2-(hydroxy-methyl)-[1,3-oxathiolan-5-yl]cytosine (FTC);  
(-)-2',3', dideoxy-3'-thiacytidine [(-)-SddC];  
1-(2'-deoxy-2'-fluoro-beta-D-arabinofuranosyl)-5-iodocytosine (FIAC);  
1-(2'-deoxy-2'-fluoro-beta-D-arabinofuranosyl)-5-iodocytosine   triphosphate  
(FIACTP);

1-(2'-deoxy-2'-fluoro-beta-D-arabinofuranosyl)-5-methyluracil (FMAU);  
1-beta-D-ribofuranosyl-1,2,4-triazole-3-carboxamide;  
2',3'-dideoxy-3'-fluoro-5-methyl-dexocytidine (FddMeCyt);  
2',3'-dideoxy-3'-chloro-5-methyl-dexocytidine (CliddMeCyt);  
2',3'-dideoxy-3'-amino-5-methyl-dexocytidine (AddMeCyt);  
15   2',3'-dideoxy-3'-fluoro-5-methyl-cytidine (FddMeCyt);  
2',3'-dideoxy-3'-chloro-5-methyl-cytidine (CliddMeCyt);  
2',3'-dideoxy-3'-amino-5-methyl-cytidine (AddMeCyt);  
2',3'-dideoxy-3'-fluorothymidine (FddThd);  
2',3'-dideoxy-beta-L-5-fluorocytidine (beta-L-FddC);  
20   2',3'-dideoxy-beta-L-5-thiacytidine;  
2',3'-dideoxy-beta-L-5-cytidine (beta-L-ddC);  
9-(1,3-dihydroxy-2-propoxymethyl)guanine;



2'-deoxy-3'-thia-5-fluorocytosine;  
3'-amino-5-methyl-dexocytidine (AddMeCyt);  
25 2-amino-1,9-[(2-hydroxymethyl-1-(hydroxymethyl)ethoxy)methyl]-6H-purin-6-one  
(gancyclovir);  
2-[2-(2-amino-9H-purin-9y)ethyl]-1,3-propandil diacetate (famciclovir);  
2-amino-1,9-dihydro-9-[(2-hydroxy-ethoxy)methyl]6H-purin-6-one (acyclovir);  
9-(4-hydroxy-3-hydroxymethyl-but-1-yl)guanine (penciclovir);  
30 9-(4-hydroxy-3-hydroxymethyl-but-1-yl)-6-deoxy-guanine, diacetate (famciclovir);  
3'-azido-3'-deoxythymidine (AZT);  
3'-chloro-5-methyl-dexocytidine (ClddMeCyt);  
9-(2-phosphonyl-methoxyethyl)-2',6'-diaminopurine-2',3'-dideoxyriboside;  
9-(2-phosphonylmethoxyethyl)adenine (PMEA);  
35 acyclovir triphosphate (ACVTP);  
D-carbocyclic-2'-deoxyguanosine (CdG);  
dideoxy-cytidine;  
dideoxy-cytosine (ddC);  
dideoxy-guanine (ddG);  
40 dideoxy-inosine (ddI);  
E-5-(2-bromovinyl)-2'-deoxyuridine triphosphate;  
fluoro-arabinofuranosyl-iodouracil;  
1-(2'-deoxy-2'-fluoro-1-beta-D-arabinofuranosyl)-5-iodo-uracil (FIAU);  
stavudine;  
45 9-beta-D-arabinofuranosyl-9H-purine-6-amine monohydrate (Ara-A);  
9-beta-D-arabinofuranosyl-9H-purine-6-amine-5'-monophosphate monohydrate  
(Ara-AMP);  
2-deoxy-3'-thia-5-fluorocytidine;  
2',3'-dideoxy-guanine; and  
50 2',3'-dideoxy-guanosine.



135. The pharmaceutical composition of claim 127, wherein said *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound is selected from the group consisting of *N*-(n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol or a pharmaceutically acceptable salt thereof, *N*-(n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates or a pharmaceutically acceptable salt thereof, and mixtures thereof; and

wherein said nucleoside or nucleotide antiviral compound is (-)-2'-deoxy-3'-thiocytidine-5'-triphosphate (3TC).

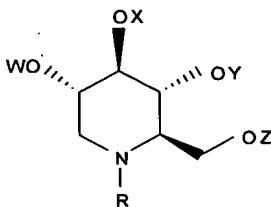
136. A pharmaceutical composition for treating a hepatitis B virus infection in a human patient, comprising:

from about 0.1 mg to about 100 mg of an *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound selected from the group consisting of *N*-(n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol or a pharmaceutically acceptable salt thereof, *N*-(n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrates or a pharmaceutically acceptable salt thereof, and mixtures thereof;

from about 0.1 mg to about 500 mg of (-)-2'-deoxy-3'-thiocytidine-5'-triphosphate; and

a pharmaceutically acceptable carrier, diluent, or excipient.

137. A salt, comprising an *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound of Formula I:



(I)



wherein R is selected from the group consisting of straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, branched chain alkyl having a chain length of C<sub>3</sub> to C<sub>20</sub> in the main chain, alkoxyalkyl, arylalkyl, and cycloalkylalkyl, and

wherein W, X, Y and Z are each independently selected from the group consisting of hydrogen, alkanoyl, aroyl, and trifluoroalkanoyl; and

a compound selected from the group consisting of a nucleoside having an acidic moiety and a nucleotide.

138. The salt of claim 137, wherein R is straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each hydrogen.

139. The salt of claim 138, wherein R is nonyl.

140. The salt of claim 137, wherein R is straight chain alkyl having a chain length of C<sub>7</sub> to C<sub>20</sub>, and W, X, Y, and Z are each alkanoyl.

141. The salt of claim 140, wherein R is nonyl.

142. The salt of claim 141, wherein said alkanoyl is butanoyl.

143. The salt of claim 137, wherein said *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound is selected from the group consisting of:

*N*-(*n*-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-octyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol;

*N*-(*n*-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol;



- 10 *N*-(n-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
15 *N*-(n-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(n-heptyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate  
*N*-(n-octyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
20 *N*-(n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-undecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-dodecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-tridecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
25 *N*-(n-pentadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-hexadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-heptadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-octadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(n-nonadecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
30 *N*-(n-eicosyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
35 *N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol;



*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(2-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(4-ethylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(5-methylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-propylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-pentylpentylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-butylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(7-methyloctyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(8-methylnonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(9-methyldecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(10-methylundecyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(6-cyclohexylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(4-cyclohexylbutyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(2-cyclohexylethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-cyclohexylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(1-phenylmethyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(3-(4-methyl)-phenylpropyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(6-phenylhexyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutyrate;  
*N*-(7-oxa-n-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;



*N*-(7-oxa-*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate;  
*N*-(7-oxa-*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
*N*-(3-oxa-*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(9-oxa-*n*-decyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(7-oxa-*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol;  
*N*-(3-oxa-*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetraacetate;  
*N*-(3-oxa-*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol; and  
*N*-(7,10,13-trioxa-*n*-tetradecyl)-1,5-dideoxy-1,5-imino-D-glucitol.

144. The salt of claim 137, wherein said nucleoside having an acidic moiety is selected from the group consisting of compounds of Formula II, III, IV, V, and VI.

145. The salt of claim 137, wherein said nucleotide is selected from the group consisting of compounds of Formula II, III, IV, V, and VI.

146. The salt of claim 145, wherein said nucleotide is selected from the group consisting of:

(-)-2'-deoxy-3'-thiocytidine-5'-triphosphate (3TC);  
1-(2'-deoxy-2'-fluoro-beta-D-arabinofuranosyl)-5-iodocytosine triphosphate (FIACTP);  
acyclovir triphosphate (ACVTP);  
E-5-(2-bromovinyl)-2'-deoxyuridine triphosphate; and  
9-beta-D-arabinofuranosyl-9H-purine-6-amine-5'-monophosphate monohydrate (Ara-AMP).

147. The salt of claim 137, wherein:  
said *N*-substituted-1,5-dideoxy-1,5-imino-D-glucitol compound is selected from the group consisting of *N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol and *N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol, tetrabutryate; and



5                    said nucleotide is (-)-2'-deoxy-3'-thiocyridine-5'-triphosphate.

148. A method, comprising reacting *N*-(*n*-nonyl)-1,5-dideoxy-1,5-imino-D-glucitol and (-)-2'-deoxy-3'-thiocyridine-5'-triphosphate under salt-forming conditions. ✓

149. A salt formed by the method of claim 148.

149. A salt formed by the method of claim 148.